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APPENDIX

A. SOURCE AND NATURE OF DATA

General commodity price indices. The leading indices of wholesale prices in the United Kingdom covering the period 1903–14 are the *Economist* and the Sauerbeck-Statist series. The *Economist* index number was, until 1911, based on the wholesale prices of 22 commodities in the London and Manchester markets. It was and, strictly speaking, is still an "unweighted" index, computed by summing the relatives based on the average prices during the period 1845–50. Weights, however, were introduced indirectly in the case of the most important commodities, through the inclusion of quotations for several varieties of the same commodity. The index had been continued in the same form for some fifty years, but in 1911 the editors of *The Economist* decided to make the list more representative, and thereupon doubled the number of quoted prices — introducing new series for fibers, foods, minerals, and miscellaneous materials. The base period was changed from 1845–50 to 1901–05, but the same method — simple addition — of combining the relatives was continued. The groups included in the general index number and the number of price series in each group, during the two periods, are shown below; the indices for separate groups are not, however, available for the entire period without computation:

	Number of Price Series	
	Previous to 1911	1911 and after
Cereals and meats	2	10
Other food products	4	6
Textiles	7	10
Minerals	4	8
Miscellaneous	5	10
Total	22	44

The Sauerbeck-Statist index number is a simple arithmetic average of relatives for 45 series of price quotations covering 38 distinct commodities with the most important commodities represented by two series of quotations. Of the 45 series of quotations 19 are for foods and 26 are for materials; among the materials there are 7 series for minerals, 8 for textiles, and 11 for miscellaneous materials. For each of these groups there is a homogeneous series of indices available in quarterly, although not in monthly, form. The base is the eleven-year period 1867–77. Originated and for many years carried on by Mr. Augustus Sauerbeck, this index has been continued since 1912 by the London *Statist.*

For the present study the Sauerbeck-Statist index has several advantages over the Economist index: (1) the former is homogeneous as to base period and selection of commodities; (2) it relates to a much larger number of commodities during most of the period under consideration; (3) it offers a useful quarterly group index of raw materials, excluding foods.

Pig-iron price index. Pig iron was selected as a good representative of the iron and steel industry. The validity of this choice was confirmed by comparisons with other price series — those for rails, rods, bars, plates, etc. Two series were selected, as reliable samples of pig-iron prices, namely "Cleveland No. 3" and "Northwest Bessemer, f. o. b." Monthly data, representing the average of prices quoted by the *Iron and Coal Trades Review,* were transcribed from official *Mines and Quarries Reports.* Cycles were computed from quarterly averages of each series separately. The cycles computed for the two series agreed very closely and were averaged to secure the figures plotted in Chart 6.

Cotton goods price index. Four standard cotton cloths and two yarns were selected from the numerous articles for which weekly quotations are given in the Manchester *Cotton Factory Times.* Prices for each of these six at dates near the tenth and twenty-fifth of each month were transcribed, and reduced to monthly averages. The following list gives the six articles for which quotations were taken:

Printers, 16 × 16 count, 32–50 yarn
Shirtings, (*a*) 16 × 14 count, 30–30 yarn
(*b*) 16 × 15 count, 9 lbs. per piece
T-cloths, 14 × 14 count, 6 lbs. per piece
Yarn (*a*) 80's count (American)
(*b*) 100's count (Bolton Egyptian)

TABLE 2. — COMMODITIES REPRESENTED IN THE SAUERBECK-STATIST INDEX OF WHOLESALE PRICES

19 FOODS

8 Vegetable foods

Wheat, English Gazette
Wheat, American
Flour, town-made, white
Barley, English Gazette
Oats, English Gazette
Maize, American, mixed
Potatoes, good English
Rice, Rangoon, cargoes to arrive

7 Animal foods

Beef, prime
Beef, middling
Mutton, prime
Mutton, middling
Pork, large and small, average
Bacon, Waterford
Butter, Friesland, fine to finest

4 Miscellaneous foods

Sugar: British West Indian refining, and German, best, 88 p.c., f.o.b.
Sugar, Java, floating cargoes
Coffee: Ceylon plantation; low middling; and Rio, good
Tea: Congo, common; average import price; and Indian good, medium

26 MATERIALS

7 Minerals

Pig iron: Scotch; and Cleveland (Middlesbrough)
Iron bars, common
Copper: Chile bars; and English tough cake
Tin, Straits
Lead, English pig
Coal: Wallsend, Hetton, in London; and Newcastle steam
Coal, average export price

8 Textiles

Cotton, middling American
Cotton, fair Dholera
Flax: St. Petersburg; Russian average import
Hemp: Manila fair roping; St. Petersburg clean
Jute: good medium
Wool: Merino, Port Phillip, average fleece; Merino, Adelaide, average grease
Wool, English, Lincoln half hogs
Silk, Tsatlee

11 Miscellaneous materials

Hides: River Plate dry; River Plate, salted, average import
Leather: dressing hides; and average import
Tallow, town
Oil, palm
Oil, olive
Oil and seeds, linseed
Petroleum, refined
Soda, crystals
Nitrate of soda
Indigo, Bengal, good consuming
Timber: hewn, average imports; and sawn or split, average imports

The geometric mean of the actual prices of these six items for each month was found, and divided by the geometric mean of all the quotations for the entire period 1903–14. From the resulting indices of the average price relative to this base period, cycles were computed and later averaged in quarterly form.

Imports and exports. The British statistics of foreign trade, collected by the Board of Trade, have been published in the *Monthly Statements of Trade and Navigation*, and in the *Board of Trade Journal and Commercial Gazette.* Our data were transcribed from the former publication, wherein for most of the period under review, convenient compilations were found in various numbers, containing monthly data for the current year and also for the two preceding years. As the data for the current year are preliminary, only those for the two preceding years were taken from a given volume. In the earliest years of the period 1903–14, however, these compilations were not found, and it was necessary to collect the data from each of the monthly issues. Here, as before, only the figures for the years preceding the current year were taken.

For single commodities, values and quantities (weight, yardage, etc.) are given. The valuation of imported commodities and groups includes the cost, insurance and freight, or, in cases of goods consigned for sale, the latest sale value of such goods. The duties on dutiable articles are excluded. The values of exported commodities represents the cost as declared by the exporter, plus the charge of delivering the goods free on board ship. The foreign trade data exclude bullion and specie shipments, exports of new ships built (with their machinery), the imports of diamonds from the Union of South Africa, and all foreign merchandise transshipped under bond. Ordinary reëxports are tabulated separately. The statistics are homogeneous throughout the entire period from January 1903 to June 1914.

Imports. In the analysis of imports the group of "raw materials and articles mainly unmanufactured" was taken for detailed study rather than the large class of imports destined for immediate consumption, viz. "food, drink, and tobacco," and "manufactured articles." The movements of the former group would be expected to indicate more clearly the fluctuation in industrial demand for foreign raw materials.

This group, however, was thought for our purposes to be too heavily weighted by the single item of raw cotton and consequently the value of cotton imports was deducted from the group total. The resulting series was found to be in fair agreement with other indices of business activity but the agreement was not sufficiently close to justify inclusion of the series in the final index of the volume of business.

Exports. The almost complete absence, prior to the war, of statistics of production in the United Kingdom lends special interest to export statistics, the more so as a large part of the output of the leading industries enters into foreign trade. Consequently three leading groups of export data were analyzed. Of these one was the total value of "exports of British produce," an item which generally amounted to four-fifths of the total exports, and is itself chiefly composed of manufactures.

The quantity of exports of two large components of this group were then studied separately, namely (1) "iron and steel and manufactures thereof" and (2) "cotton piece-goods." Each of these groups of products averaged, in value, about one-quarter of all manufactured exports. Of these group-exports the series for iron and steel products alone proved moderately useful, though much less satisfactory than the total exports of British produce.

In addition to the data for imports and exports, figures for the tonnage of shipping entered and cleared through ports of the United Kingdom were examined, but these figures were found not to be good indices of the fluctuations in foreign trade.

Bank clearings in five provincial cities. Reliable data for the value of checks cleared each week through the clearing houses of several provincial cities have been published for a considerable period in various financial periodicals. The London *Bankers' Magazine* publishes the weekly data in a convenient cumulative form; the early issues of each year summarize practically the entire preceding year in a single table. The data utilized in our study were taken chiefly from this source, use being made of the current tables in the *Economist* for the purpose of checking doubtful items. The figure representing each quarter is an aggregate of twelve weekly items, so distributed that four weeks fall within each calendar month, the week containing the first of the month always being included; data for certain weeks, therefore, were omitted. The clearings in five cities only were used: Manchester, Birmingham, Bristol, Sheffield, and Leeds, the others being omitted because of insignificance in amount, lack of homogeneity during the period, or (in the case of Liverpool) the figures showed erratic movements out of accord with the general movement. It is believed that the selection is sufficiently large and typical to represent the fluctuations of provincial bank clearings in general.

Percentage unemployed in all trades. These data are the percentages unemployed on one day near the end of each month in "all trades" as reported by the *Labour Gazette.* The sources used were an early issue, usually January, in each year, summarizing the monthly data for the entire year. The industries covered do not remain the same through the period; but they are chiefly engineering, shipbuilding, metals, building, printing, woodworking, and (after 1907) textiles and coal mining. The percentages unemployed are based on reports from the secretaries of trade unions having unemployment-benefit arrangements. The nature of the field covered is shown by Table 8 on page 40 of the REVIEW for January, 1922. The total membership of reporting mines varied from 360,000 in June 1903 to 993,000 in June 1914. The returns exclude those who are unemployed on account of disability, sickness, or the direct effect of labor disputes. In order to obtain figures which would vary directly, rather than inversely, with other indicators of business conditions, the adjusted figures for unemployment, computed in the usual way, were inverted by reversing the algebraic signs of the figures. These reversed cycles are therefore an index of the general state of employment.

Number of blast furnaces in blast. This series was taken from the *Labour Gazette.* The figures are reported each month in the section devoted to activity in the pig-iron industry, and cover the preceding month and the corresponding month of the previous year. Since the data as first published, however, are subject to revision, care was taken to secure the finally revised figures. According to John Hilton of the Ministry of Labour, "the figures for recent years represent over 90 per cent of the total furnaces in blast" of the country; they are supplied by the ironmasters themselves, and appear to be trustworthy. This is the only monthly series which we have found in published form indicative of iron production for this period. The systematic publication of actual iron and steel output by months has only recently been begun; but the data for furnaces in blast when compared with the figures for iron and steel production show the former series to be a trustworthy index of iron and steel production.

Stores of pig iron in public warehouses. This series gives the stock of Cleveland pig iron each month in Connal's storage yards, as stated by the *Economist* in its *Monthly Trade Supplement.* Connal and Company maintained warehouses at important iron centers, such as Middlesbrough (in the Cleveland district), Glasgow, etc., in which blast furnace operators could store their product and secure credit in the form of "warrants," analogous to the warehouse receipts in use at large terminal elevators in the United States. The leading kind of pig iron was "Cleveland" during the years 1903–14. Unfortunately the series has not been published since the early years of the war. In response to an inquiry concerning this series the editor of the *Iron and Coal Trades Review* wrote on August 9, 1921: "There is no longer any stock of pig iron in Connal's storage yards, as the makers decided that to put iron in storage was not in the best interests of the trade. . . . It was possible for a maker to sell his warrants, once the pig iron was in Connal's yards, and thereby obtain cash to continue business." These warrants facilitated speculation. The curve based on the adjusted figures for this series proved to be smooth and definitely cyclical in form, and its movements were found to precede changes in the volume of industrial activity by about one year.

Railway freight traffic receipts. Figures for the volume of railway traffic or the receipts arising from such traffic for the entire country are available in government reports for the pre-war period under consideration in semi-annual and annual form but not for shorter intervals. Weekly estimates of railway earnings were, however, given to railway and other periodicals for many years prior to the war. The most satisfactory compilations are to be found in the London *Statist,* which published the receipts of 16 railways from (*a*) passenger traffic, (*b*) freight traffic, and (*c*) the two combined. Accompanying these data for weekly earnings appear cumulative totals covering all previous weeks in the current calendar year. The quarterly receipts for freight traffic which were utilized in this analysis were obtained by tabulating the cumulative aggregates at the end of the 13th, 26th, 39th, and 52nd weeks in each year, and subtracting each from its successor. The series so constructed appeared to be quite trustworthy, notwithstanding slight variations in the practice of including or excluding the revenues from joint lines, and the errors which doubtless are present in the individual weekly reports upon which the totals are based.

The 16 railways covered differ widely in importance. The largest freight handlers are the Midland, the London and Northwestern, the Great Western, and the Northeastern railways. The entire list of 16 railways, the mileage and the freight receipts in 1913 for each are given in the accompanying table.

TABLE 3. — MILEAGE AND FREIGHT RECEIPTS IN 1913 OF THE 16 RAILWAYS REPRESENTED IN THE STATIST'S COMPILATIONS

Railway	Mileage at end of 1913	Freight receipts in 1913 (£1,000)
1. Midland	1,582	9,091
2. London & Western	1,969	8,819
3. Great Western	2,984	7,847
4. Northwestern	1,734	7,403
5. Great Northern	1,032	3,904
6. Great Central	661	3,703
7. Lancashire and Yorkshire	597	3,575
8. North British	1,286	3,189
9. Caledonian	1,117	3,040
10. Great Eastern	1,208	2,690
11. London & Western	967	1,663
12. Southeastern & Chatham Rys.	654	1,185
13. Glasgow & Southwestern	471	1,066
14. London, Brighton & South Coast	487	842
15. Great Southern and Western (Ireland)	1,131	823
16. North London	16	250
Total	17,896	59,090

London bank clearings. The clearings of banks belonging to the London Clearing House are reported in most convenient form in the *Bankers' Magazine.* Monthly data for several months are given in each issue, and the February issue each year presents a summary covering the monthly totals for the previous year. This compilation includes, not only the total clearings, but also, separately, the amount of the clearings on the (*a*) fourths of the month, (*b*) consols settling days (one day each month), and (*c*) stock exchange settling days (two days each month). These comprise about 4 per cent, 4 per cent, and 15 per cent, respectively, of the total monthly clearings. Figures for the volume of security transactions are not published, but bank clearings on stock exchange settlement days are probably a fair substitute for them. Since the war these figures have not been compiled and made available by the clearing house.

Upon examination of the four series it was found that they exhibit distinct types of fluctuations. Clearings on the fourths of the month and on consol settling days appear to bear no uniform relation to the fluctuation of business as indicated by the series which we have selected as standards. As between the total clearings and those of stock settling days (which fluctuate together and, in general, well in advance of commodity prices) the latter is the more consistent forecaster of business conditions.

In addition to the classification of London bank clearings just described, a geographical classification of clearings is to be found in the *Statist*. That journal gives both weekly totals and cumulative aggregates for clearings in "town," "metropolitan" and "country" districts. Only the latter class was found to be useful. This class includes the provincial checks, etc., which the country bankers clear through their London correspondents. These country clearings through London were found to fluctuate with other business series but the agreement with such series was not as close as that of the series for total bank clearings of five of the provincial cities, previously described.

Merchant shipbuilding under construction. The quarterly data used were taken from the *Economist*, which reprints them in its special articles on shipbuilding from *Lloyd's Register of Shipping*. The figures represent the gross tonnage of all merchant ships of a tonnage exceeding 100 tons under construction at the end of each quarter, as reported by Lloyd's agents. The series was found not to be a good index of business activity.

Industrial profits. This series represents the net profits after payment of debenture interest, as declared in the reports of individual companies. It is published quarterly in the *Economist* but the series has the disadvantage that it does not begin (except in annual form) until 1908.

Cotton forwarded. In order to secure figures showing the actual consumption of imported cotton by the mills, examination was made of the data of "cotton forwarded" from Liverpool as given in several of the financial journals. The data quoted in the New York *Commercial and Financial Chronicle* were found to be arranged in more complete and convenient form than those in British publications. The *Chronicle* figures, which that journal obtains by cable, indicate the number of bales forwarded from ports (chiefly Liverpool) to inland centers during the first four weeks of each month. The cycles resulting from these data do not differ greatly from those of raw cotton imported and of cotton goods exported, but the relation of none of these series to other series indicating business activity is sufficiently systematic to warrant their use in an index of general business conditions.

Market values of representative securities. An important collection of statistics of security values has been published monthly for many years in the *Bankers' Magazine*. The basic data are quotations on the London Stock Exchange on one day in the latter half of the month for more than 300 securities. Data for both the current and the preceding month are published together. The method employed by the *Bankers' Magazine* is (1) to multiply the price of each security by the par value of the outstanding stock, (2) to take the sum of the resulting products for all securities within a group, and then (3) to find the aggregate of the group totals. In other words, these "total market values" are aggregates of security prices, each weighted according to the size of its issue. The data appear to have been prepared with care, and to merit confidence; though a detailed check upon them is impossible because the individual basic quotations are not published.

In utilizing these weighted indices of security prices two difficulties were encountered; one concerned the homogeneity of the series, the other the nature of the securities combined. At the end of 1906 the *Bankers' Magazine* revised its list of securities, increasing or decreasing the number in most of its groups. For this reason neither the group totals nor the grand aggregate are homogeneous in their original form during the periods 1903–06 and 1907 to date; but fortunately adjustment is possible, as complete data on both the old basis and the new, are given for the month of December 1906. For each group the monthly data for the years 1903–06 were multiplied by a constant equal to the ratio of the new to the old figure for December 1906. The second difficulty has to do with the character of the securities included in aggregate. The aggregate is based upon the prices of a very wide variety of securities: public and private; fixed-income and variable-income; British, colonial, and foreign (see Table 4). In order to secure more homogeneous figures the aggregate was divided into two classes, fixed-income and variable-income securities. Further, certain groups which offered special promise as registers of either speculation or investment were transcribed, charted, and studied.

The groups which were analyzed in this way are indicated by asterisks in Table 4. As was expected, a considerable degree of dissimilarity in the form and sequence of their movement was disclosed. Group 2, British corporation stocks, corresponding to local government bonds in the United States, and also the total of Groups 1–11, the leading fixed-income groups (when inverted to show yield) were found to lag about six months after prices. The agreement between these two registers of the price of investment securities was extremely close, but the former, representing British corporation bonds alone, was selected to represent the investment group. Two other groups proved to be good forecasters: Group 12, ordinary stocks of British railways, and also the total of Groups 12–36, representing chiefly variable-income securities.[1] Group 29, coal, iron and steel, seemed to move concurrently with prices, and Group 31, commercial and industrial, showed no consistent relationship to commodity prices.[2]

London discount rates. The discount rates which were examined comprise the Bank of England "official" rates, market rates for "floating money" (day-to-day loans), and for paper maturing in two, three, and six months. The Bank rate was taken from the *Statistical Abstract for the United Kingdom*, vol. 65, p. 374, which gives the average minimum rate for each month of the entire period. The market rates for floating money and for two- and six-months paper were taken from the section entitled "Monetary Review" which appears early in each year in the *Bankers' Magazine*. These figures pertain to a date near the twentieth of each month. From the *Economist* a further series of rates on three-months paper was compiled in the form of both monthly and quarterly averages of the ruling quotations in four weeks of each month. Comparison of the series derived from data representing four quotations and those representing but one quotation each month, revealed only minor differences between the two series of quotations. Furthermore, the market rates for the several maturities agreed in their movements so closely that an average of them was deemed unnecessary, and the rate on three-months paper alone was used.

As between the Bank rate and the market rate, it was found that the former was not useful for the purpose in hand, as it responded less promptly and accurately to general money market conditions, than did the latter. The Bank rate is less sensitive than the market rate; in other words, it remains constant for long periods during which the market rate vibrates; the latter class of rates, therefore, and particularly the rate on three-months paper, is superior to the Bank rate as an index of the money market.

Net import of gold. This series represents the difference between the amount of gold bullion and coin imported, and that exported. It is taken from the official *Monthly Statements of Foreign Trade*, etc., in a manner like that already explained under *Foreign trade*. The movements of the curve, even after the elimination of the seasonal variation, resemble those of other series only very slightly; no instructive relationships were discovered.

Yield of consols. The source of the prices of consols used in this series was the *Statistical*

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[1] The aggregate of all groups combined also proved to be a forecaster, but it was not utilized because of its heterogeneous composition.

[2] That no other groups than those already specified were worthy of separate treatment was demonstrated by a close study of logarithmic charts of both annual and monthly items which were put at our disposal by Professor Joseph S. Davis, of Harvard University.

TABLE 4. — GROUPS OF SECURITIES REPRESENTED IN THE BANKERS' MAGAZINE AGGREGATES OF MARKET VALUES OF SECURITIES

	1896–1906		1907–21	
	No.	Par value (*thousands*)	No.	Par value (*thousands*)
1. British and Indian funds	14	£800,194	9	£862,786
2. *British corporation stocks	8	36,379	7	52,250
3. Colonial government stocks	11	49,417	11	82,850
4. Colonial inscribed stocks	5	29,823		
5. Foreign government stocks	30	928,539	31	881,950
6. Corporation stocks, colonial and foreign	8	7,038	10	18,250
7. British railway debenture	14	171,118	11	133,500
8. British railway preference	13	128,803	13	149,500
9. American railway bonds (gold)	12	59,545	16	178,000
10. American railway bonds (sterling)	5	7,605		
11. Foreign railway obligations	9	84,216		
12. *British railway ordinary stocks	19	213,007	26	310,750
13. Indian railway ordinary stocks	7	47,010	5	26,000
14. Railways in British possessions	8	56,014	9	88,440
15. American railway shares	10	89,000	17	346,000
16. Foreign railways	12	19,516	24	63,940
17. Water	10	8,553	4	2,715
18. Gas	4	10,842	5	28,635
19. Electric light and power			6	3,180
20. Tramway and omnibus	11	4,066	7	4,970
21. Canal and docks	6	20,716	4	9,000
22. Telegraph and telephone	9	17,914	4	8,885
23. British bank shares	10	35,190	23	39,513
24. Australian bank shares	4			
25. Other colonial bank shares	6			
26. Semi-foreign bank shares	10		13	15,420
27. Financial, land	8	6,167	11	7,120
28. Insurance	14	3,956	21	5,390
29. *Coal, iron and steel	7	6,055	8	11,910
30. Breweries	8	4,529	18	15,900
31. *Miscellaneous, commercial, industrial, etc.	15	9,944	38	36,701
32. Shipping	8	4,966	7	7,200
33. Indian tea				
34. South African mines	10	8,810	15	20,704
35. Copper mining shares			6	9,703
36. Mining, miscellaneous			8	3,424
1–36. *Aggregate	325	2,868,932	387	3,424,600
1–11. *Leading fixed-income groups	129	2,302,677	108	2,359,100
12–36. *Aggregate minus leading fixed-income groups	196	566,255	279	1,065,500

* Groups which were analyzed separately are indicated by an asterisk. The last three groups do not appear in the original tables.

Abstract of the United Kingdom for 1917, vol. 62, p. 373. The data are given there for the average monthly price per £100 of the "new 2½ per cent British Consolidated Fund Stock of the public funds" (during the first half of 1903 consols still bore the old rate of 2¾ per cent). As there is no fixed date of maturity for these securities, the yield to investors was calculated by dividing the rate of interest by the average prices. This series, when adjusted by the standard method, shows a pronounced lag after prices, and even after the short-time discount rate with which one might have expected it to agree rather closely. The agreement of the yield on consols with the yield on local government bonds and on all fixed-income groups of the *Bankers' Magazine* — as indicated roughly by the prices of the latter, with cycles reversed — is close.

New capital applications. The *Economist* and the *Investors' Monthly Manual* both publish quarterly and monthly figures for the amount of capital applied for by prospectus in the United Kingdom. The totals are apparently compiled from the weekly lists of capital applications based on the prospectuses actually received, and show the amounts applied for by governmental and private bodies alike, as well as applications from domestic and foreign sources. They exclude vendors' shares and sums privately invested in new enterprises. Some of the series which are given for a large number of separate groups were tested, singly and in various combinations, with special attention to the following nine groups:

British railways
Manufacturing
Iron, coal, steel and engineering
Merchants, importers and exporters
Stores and trading
Electric lighting, power, etc.
Gas and water
Docks, harbors and shipping
Banking and insurance

This investigation yielded no positive result. Apparently the nature of the factors entering into "applications" for new issues is such as to subject the series to erratic fluctuations in an extreme degree.

Loans, discounts, etc., of London joint-stock banks. Monthly data are given in the London *Economist* based on the detailed reports of monthly condition of several joint-stock banks belonging to the London Clearing House. These relate to numerous items in the banking account, among which "loans, discounts, etc." seemed the most promising. Attention was confined chiefly to four banks, which formed a fairly large and representative quota of the London clearing banks. These were: (1) Lloyd's, (2) London, City, and Midland, (3) London and Westminster, and (4) National Provincial. The series were tested for 1905–09, during which period all but the third series were homogeneous. It was found, however, that the series for no single bank or combination of banks showed an unmistakable cyclical movement. This may have been due, in part, to numerous minor amalgamations and lack of standardization in the bank reports.

Bank of England reports. Abstracts of the weekly reports of the accounts of the Bank of England are published in convenient and accurate form by the *Bankers' Magazine* in the section entitled "Bank of England — Analysis of Returns." Although ten or more items of the account are normally stated there, our attention has been confined to three: (1) reserve, (2) other than public deposits, and (3) other than public securities in the Banking Department. The adjusted series exhibited fluctuations so erratic in nature as almost wholly to obscure any underlying cyclical tendency, if such existed.

B. THE STATISTICAL METHOD EMPLOYED

In most of the series examined, three types of fluctuation are apparent — secular trend, seasonal variation, and a wave-like movement. The series for freight traffic receipts of sixteen British railways, shown in Chart 16, will be used to illustrate these fluctuations and the method of handling them. In the series taken for illustration the secular trend is upward; the seasonal variation takes the form of a fall in the first, second, and third quarters and a very pronounced rise in the fourth quarter; the cyclical movement can be detected on the chart as a rise in 1906–07, a fall in 1908, a rise in 1909–11, and a fall in 1913–14. It is obvious that the trend and the seasonal variation tend to conceal the cyclical movement in which we are primarily interested. We find it necessary to measure secular trend and seasonal variation in order to eliminate them and isolate the cyclical movement.

The method of measuring the secular trend is: (1) to compute the annual average of the items for each of the years from 1903 to 1913, inclusive; (2) to fit a straight line to these 11 annual averages by the mathematical method of least squares;[1] and (3) to compute the ordinates of secular trend at each quarter during the entire period. The "straight line of secular trend" for railway receipts is shown on Chart 16.

In measuring seasonal variation, the first step was to determine whether or not the figure for

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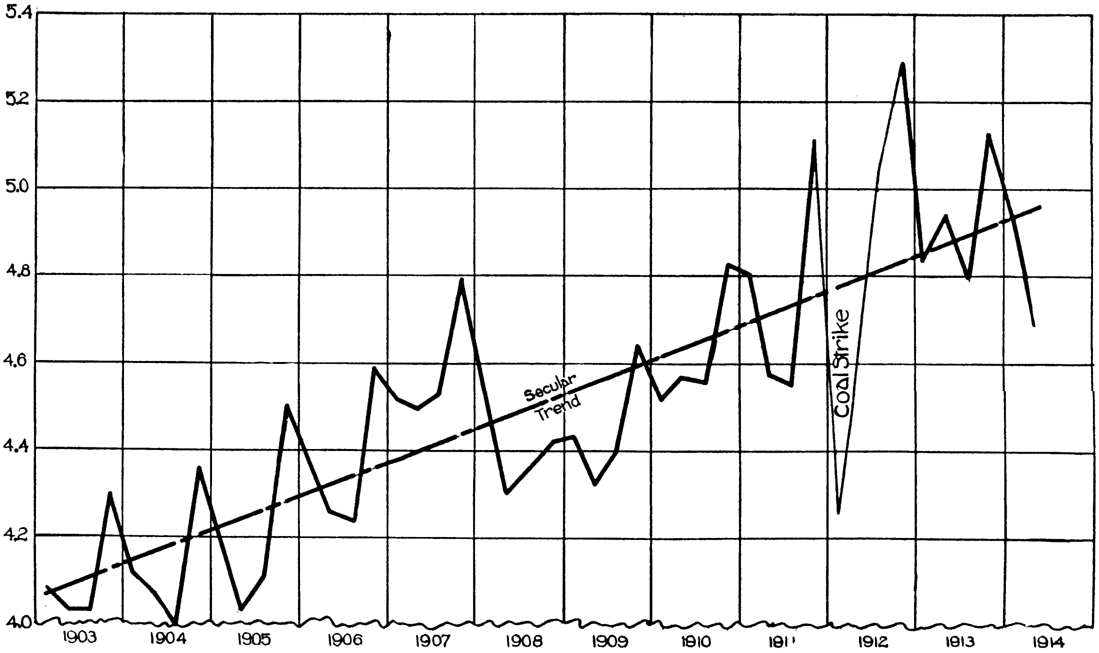
[1] See this REVIEW, January, 1919, pp. 12, 13.

Chart 16. — Freight Receipts of Sixteen British Railways with Line of Secular Trend



each quarter was regularly higher or lower than the figure for the preceding quarter, and by how much. This was determined (1) by computing the ratio of each item in the series to the item preceding it, and (2) observing how these ratios (quarter-to-quarter link relatives) grouped themselves when arrayed in a frequency table (Tables 6 and 7).

Table 5. — Monthly Average Freight Traffic Receipts of 16 Railways: Quarterly, 1903–14

(*Unit: £1000*)

	First quarter (Q_1)	Second quarter (Q_2)	Third quarter (Q_3)	Fourth quarter (Q_4)
1903	4080	4034	4028	4299
1904	4115	4069	3996	4359
1905	4191	4033	4109	4503
1906	4381	4263	4239	4586
1907	4521	4500	4526	4793
1908	4532	4297	4360	4425
1909	4430	4322	4402	4640
1910	4519	4567	4562	4819
1911	4804	4567	4549	5114
1912	4258	4596	5042	5287
1913	4835	4943	4792	5128
1914	4945	4693	....	....

Table 6. — Quarter-to-Quarter Link Relatives for Freight Traffic Receipts of 16 Railways

(*Unit: one per cent*)

	$\frac{Q_1}{Q_4}$	$\frac{Q_2}{Q_1}$	$\frac{Q_3}{Q_2}$	$\frac{Q_4}{Q_3}$
1903	...	99	100	107
1904	96	99	98	109
1905	96	96	102	110
1906	97	97	100	108
1907	98	100	101	106
1908	95	95	101	101
1909	100	98	102	105
1910	97	101	100	106
1911	100	95	100	112
1912	83*	108	110	105
1913	92	102	97	107
1914	96	95	...	...

* Low value due to national coal dispute.

If there were no seasonal variation, successive link relatives would "cluster" about 100 per cent (assuming no element of trend). In the present case, however, the four columns of link relatives are grouped about different centers. This is shown in Table 7, in which the fourth quarter of the year usually exceeds that for the third quar-

TABLE 7. — FREQUENCY TABLE OF QUARTER-TO-QUARTER LINK RELATIVES FOR FREIGHT RECEIPTS OF 16 RAILWAYS (WITH MEDIANS AND ADJUSTED INDICES OF SEASONAL VARIATION)

Per cent	$\frac{Q_1}{Q_4}$	$\frac{Q_2}{Q_1}$	$\frac{Q_3}{Q_2}$	$\frac{Q_4}{Q_3}$
92	I (I)*	..	..	..
93	..	..	..	..
94	..	..	..	..
95	I	II	..	..
96	III	I	..	..
97	II	I	I	..
98	I	I	I	..
99	..	II	..	..
100	II	I	IIII	..
101	..	I	II	I
102	..	I	II	..
103	..	..	..	..
104	..	..	..	..
105	..	..	..	II
106	..	..	..	II
107	..	..	..	II
108	..	I †	..	I
109	..	..	..	I
110	..	..	I †	I
111	..	..	..	..
112	..	..	..	I
Median link relative	96	99	100	107

	First quarter	Second quarter	Third quarter	Fourth quarter
Chain relative unadjusted	100	99.0	99.0	105.9
Chain relative adjusted	100	98.6	98.1	104.6
Adjusted indices of seasonal variation ‡	99.7	98.3	97.8	104.2

* This relative is 83, an exceptionally low value due to the national coal dispute.

† Extreme values due to the national coal dispute in first quarter 1912, and its aftermath.

‡ Average for year is 100.

ter by about 7 per cent (median link relative = 107 per cent). The figure for the third quarter is approximately the same as that for the second; the second falls one per cent below the first, and the first quarter falls below the fourth quarter of the preceding year by about 4 per cent.

The median link relatives, just referred to, were transformed into "chain relatives," or relatives with the first quarter as a fixed base. But the element of trend is interwoven with the element of seasonal variation in these relatives, as shown by the fact that the product of the four median link relatives is 101.7, not 100. The discrepancy (in this case 1.7 per cent) was distributed among the four quarterly relatives. This process yields adjusted chain relatives with the first quarter as a base. The final step is simply to change the base, from the first quarter to the average for the entire year. The resulting "adjusted indices of seasonal variation" indicate the ratio which the figure for any quarter, with the trend eliminated, normally bears to the average of the year.

Having measured the trend and seasonal variation, the problem of eliminating them now arises. This is accomplished in the following manner: (1) the original item is divided by the corresponding ordinate of secular trend (e. g., in the fourth quarter of 1907, 4793 ÷ 4437 = 108.0); (2) from the resulting quotient is subtracted the corrected index of seasonal variation (108.0 − 104.2 = 3.8). These two processes eliminate the secular trend and the seasonal variation from each original item; the resulting figures are given in Table 8 and plotted in Chart 17.

TABLE 8. — QUARTERLY PERCENTAGE DEVIATIONS OF ORIGINAL ITEMS FROM SECULAR TREND ADJUSTED FOR SEASONAL VARIATION; FREIGHT TRAFFIC RECEIPTS OF 16 RAILWAYS

(*Unit: one per cent*)

	First quarter	Second quarter	Third quarter	Fourth quarter
1903	+ .6	+ .5	+ .4	+ .2
1904	− .5	− .5	−2.2	− .3
1905	− .6	−3.2	−1.3	+1.1
1906	+ 2.0	+ .4	0	+1.1
1907	+ 3.4	+4.0	+4.6	+3.8
1908	+ 1.8	−2.3	− .8	−6.1
1909	− 2.1	−3.4	−1.6	−3.1
1910	− 2.0	+ .3	+ .2	−1.0
1911	+ 2.4	−1.4	−1.7	+3.5
1912	−10.7	−2.4	+7.0	+5.3
1913	− .3	+3.1	+ .2	+ .3
1914	+ .4	−3.5	....	....

When we come to compare the curves based o the adjusted figures of different series with eac other, we find that some of the series fluctuat very much more violently than others. Som series fluctuate within a range of 10 per cen while others vary 50 or 100 per cent. This variety makes comparison difficult if the curves ar plotted on the same percentage scale. Since the prime object of this study is the sorting of the series with reference to their time relationships, it is necessary to use some device to secure comparable units for the several series. This is done by simply computing, for each series, the standard deviation (σ) of the adjusted figures last obtained, and dividing that series through by its σ. In the present case $\sigma = 3.01$, therefore the cyclical value is $3.9 - 3.01$ or 1.3. The results represent the completely adjusted "cycles" for the series. This last step magnifies the amplitude of the less sensitive series, and diminishes those which fluctuate more widely, so that the maximum range of variation of the cycles for all the series is generally between $+2\sigma$ and -2σ (see Table 9).

The "cycles" were plotted on translucent paper, and compared with the "cycles" of prices and other series, successively, by moving one curve backward or forward along its time axis until the best agreement was obtained. For each pair of series compared three questions were asked: (1) What is the grade of excellence of the

TABLE 9. — QUARTERLY CORRECTED CYCLES FOR FREIGHT TRAFFIC RECEIPTS OF 16 RAILWAYS

(*Unit: one standard deviation*)

	First quarter	Second quarter	Third quarter	Fourth quarter
1903........	+ .2	+ .2	+ .1	+ .1
1904........	− .2	− .2	− .7	− .1
1905........	− .2	−1.1	− .4	+ .4
1906........	+ .7	+ .1	0	+ .4
1907........	+1.1	+1.3	+1.5	+1.3
1908........	+ .6	− .8	− .3	−2.0
1909........	− .7	−1.1	− .5	−1.0
1910........	− .7	+ .1	+ .1	− .3
1911........	+ .8	− .5	− .6	+1.2
1912........	−3.6	− .8	+2.3	+1.8
1913........	− .1	+1.0	+ .1	+ .1
1914........	+ .1	−1.2	....	....

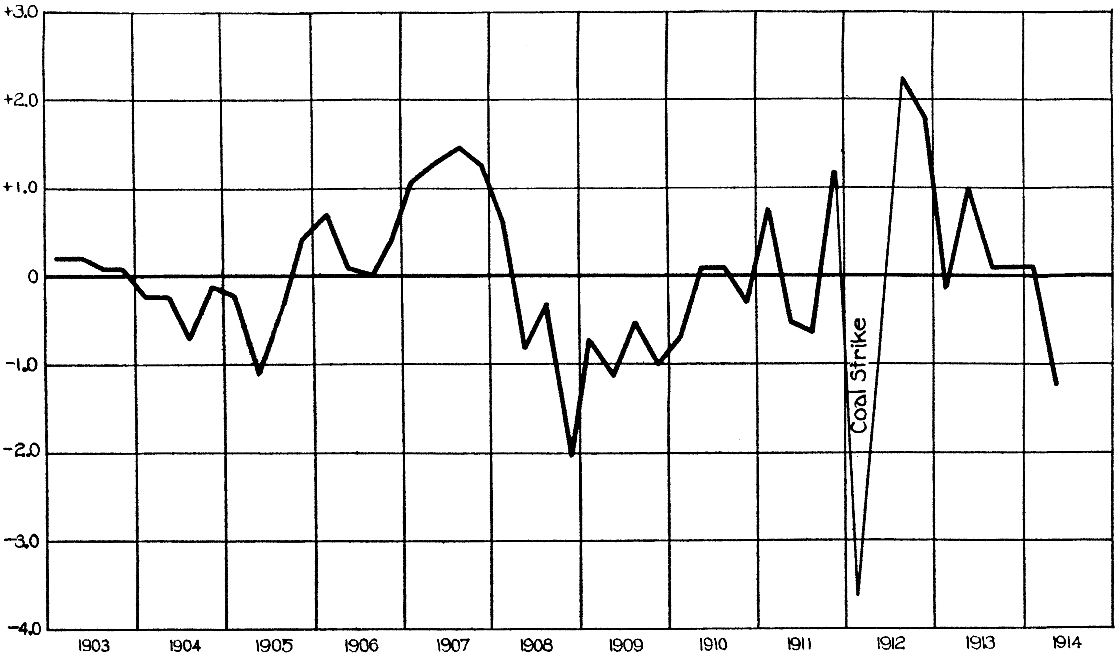
TABLE 10. — INDICES OF SEASONAL VARIATION AND CONSTANTS FOR LINES OF SECULAR TREND FOR SELECTED SERIES: 1903–14

Key no.	Name of series	INDICES OF SEASONAL VARIATION				CONSTANTS FOR LINES OF SECULAR TREND *		
		QUARTER				Unit	Initial ordinate (b) (first quarter, 1903)	Quarterly increment (m)
		I	II	III	IV			
1	Sauerbeck-Statist prices of all "materials" ...	†	†	†	†	one per cent	71.8	+ .38
2	Exports (value) of British produce.........	100	95	101	102	£1,000,000	23.6	+ .446
3	Bank clearings in 5 provincial cities	105.4	96.6	95.9	102.1	£1,000,000	27.1	+ .290
4	Percentage unemployed in "all trades"......	103	91	100	106	one per cent	5.86	−.0555
5	Number of blast furnaces in blast..........	†	†	†	†	one furnace	324	− .68
6	Exports (quantity) of iron and steel........	94	102	102	102	1,000 tons	.303	+ 2.69
7	Freight traffic receipts of 16 railways........	99.9	98.3	97.8	104.1	£1,000	4060	+ 19.8
8	Imports (value) of raw materials, excluding cotton...............................	108	99	95	98	£1,000,000	10.1	+ .164
9	Country bank clearings through the London clearing house	102	99	97	102	£1,000,000	68.6	+1.043
10	London bank clearings on stock settling days .	102	103	94	101	£1,000,000	131.9	+ 1.46
11	Market values of variable income securities (*Bankers' Magazine* total, less fixed-income securities............................	†	†	†	†	£1,000,000	1561	− 2.15
12	Market values of selected British railway ordinary stocks......................	101	100	99	100	£1,000,000	316	− .994
13	Stores of Cleveland pig iron in public warehouses..............................	102	102	99	97	1,000 tons	261.5	+ 2.46
14	Discount rate on 3-months paper in London ..	104	89	83	124	one per cent	3.0	+.0126
15	Market values of 7 local government bonds...	†	†	†	†	£1,000,000	50.9	− .116

* The equation to the line of secular trend may be secured by substituting the tabulated values of b and m in the equation $y = mt + b$; where t represents the time measurement in quarters and y the ordinate.

† Seasonal variation negligible; indices not computed.

Chart 17. — Adjusted Figures (Cycles) for Freight Receipts of Sixteen British Railways



general fit? (2) For what lead or lag, in quarters, on the whole is the fit best? (3) With what grade of consistency is this lead or lag maintained throughout the period 1903–14? This method of measuring correlation by inspection was checked, in the cases of significant relationship, by computing coefficients of correlation. The result of the intercomparison of various series is given in Table 1 (p. 161).

The leading statistical constants for each important series are tabulated in Table 10, the original items in Table 11, and the corrected cycles in Table 12.

TABLE 11. — ORIGINAL ITEMS FOR SELECTED SERIES: QUARTERLY, 1903–14

1. Sauerbeck-Statist prices of all "materials"
2. Exports (value) of British produce
3. Bank clearings in 5 provincial cities
4. Percentage unemployed in "all trades"
5. Number of blast furnaces in blast
6. Exports (quantity) of iron and steel
7. Freight traffic receipts of 16 railways (see Table 5 for data)
8. Imports (value) of raw materials excluding cotton
9. Country bank clearings through the London clearing house
10. London bank clearings on stock settling days
11. Market values of variable income securities (*Banker's Magazine* total, less fixed-income securities)
12. Market values of selected British railway ordinary stocks
13. Stores of Cleveland pig iron in public warehouses
14. Discount rate on 3-months paper in London
15. Market values of 7 local government bonds

(*Quarterly averages of monthly items*)

Quarter	1	2	3	4	5	6	8	9	10	11	12	13	14	15
	per cent	*mill. £*	*mill. £*	*per cent*	*1 fur.*	*thous. t.*	*mill. £*	*mill. £*	*mill. £*	*mill. £*	*mill. £*	*thous. t.*	*per cent*	*mill. £*
1903 I	72.4	24.3	29.4	4.4	329	297	10.5	75.1	134	1589	331	130	3.5	51.2
II	71.8	23.2	26.7	3.7	325	328	10.7	72.8	122	1562	327	137	3.2	51.1
III	71.2	25.0	27.0	4.9	319	290	11.1	71.9	115	1529	317	132	3.0	50.7
IV	72.1	24.5	27.5	5.8	310	309	10.7	75.3	115	1494	307	71	3.8	49.8
1904 I	74.2	24.1	29.2	5.7	299	252	11.0	74.3	117	1470	301	101	3.1	49.4
II	71.4	24.0	27.1	5.6	306	293	10.9	72.8	122	1519	316	84	2.2	49.6
III	71.3	25.7	27.2	5.9	301	265	10.3	71.6	116	1510	305	88	2.6	49.6
IV	72.5	26.5	29.5	6.6	303	278	10.2	75.3	156	1569	314	156	2.8	50.0
1905 I	72.3	26.1	30.2	5.7	311	269	11.6	75.9	182	1606	321	289	2.4	50.5
II	73.0	25.8	28.6	4.9	321	311	10.9	74.7	166	1611	317	461	2.1	50.6
III	75.2	28.9	29.2	4.8	323	338	10.8	76.9	164	1618	311	538	2.2	49.9
IV	78.5	29.2	31.8	4.5	333	323	12.0	82.4	178	1640	321	674	3.9	49.3
1906 I	80.1	30.4	32.7	3.9	337	331	13.1	83.5	178	1638	320	737	3.7	49.7
II	82.5	29.8	31.3	3.2	340	372	12.8	81.0	161	1611	311	671	3.4	49.4
III	83.0	32.5	31.6	3.2	339	417	12.5	81.2	164	1604	308	612	3.4	48.8
IV	86.9	32.5	34.5	4.1	342	443	13.4	84.0	174	1600	297	553	5.6	48.4
1907 I	88.2	34.0	36.1	3.5	345	423	15.6	88.0	188	1568	299	484	4.9	48.3
II	88.7	34.8	33.8	3.0	347	475	14.4	91.0	146	1472	288	228	3.5	47.3
III	85.1	37.7	34.4	3.6	345	437	13.2	85.8	133	1412	279	183	3.9	47.4
IV	80.1	35.6	35.9	4.8	323	388	13.8	92.8	142	1349	281	96	5.6	47.5
1908 I	76.0	33.1	35.8	6.1	299	330	13.0	91.6	128	1370	285	86	3.4	48.7
II	73.2	30.3	31.3	7.5	287	363	12.0	87.2	132	1387	281	58	2.0	49.2
III	73.1	31.9	31.0	8.6	271	344	11.9	85.3	142	1417	275	62	1.4	49.5
IV	74.0	30.5	29.9	9.1	289	331	12.3	90.6	155	1457	276	106	2.1	49.1
1909 I	73.0	29.6	32.7	8.4	285	310	13.6	89.6	166	1462	277	174	2.4	49.2
II	74.1	29.4	30.3	8.0	287	357	12.6	88.5	189	1518	282	221	1.5	50.2
III	75.9	33.5	31.0	7.7	292	357	12.8	89.0	169	1562	281	286	1.4	50.1
IV	78.2	33.7	32.9	6.7	300	381	14.3	95.9	186	1540	273	362	3.9	49.4
1910 I	80.0	33.6	33.5	5.9	303	365	16.3	96.3	203	1540	282	308	2.8	49.0
II	79.9	34.6	33.9	4.1	311	395	17.6	102.0	190	1544	286	430	3.3	48.7
III	80.4	38.0	33.0	4.0	311	385	14.7	97.2	176	1504	283	442	2.6	48.3
IV	82.7	37.3	36.2	4.7	308	386	14.7	100.2	185	1511	286	499	4.0	47.7
1911 I	83.6	38.1	38.4	3.4	309	365	16.2	102.9	190	1533	299	554	3.0	48.2
II	84.5	36.5	35.5	2.8	292	393	14.6	99.7	199	1554	309	575	2.3	47.9
III	81.9	35.8	35.5	3.0	285	334	13.3	98.4	178	1506	291	566	2.7	47.0
IV	81.9	41.0	38.4	2.8	291	414	14.9	105.9	174	1491	289	543	3.7	47.0
1912 I	84.2	39.5	37.8	5.6	207	429	17.0	103.7	195	1494	288	490	3.5	47.0
II	86.7	35.6	35.6	2.9	262	322	15.0	110.9	206	1520	286	343	3.0	47.1
III	89.7	43.0	38.8	2.3	325	428	15.9	107.1	180	1528	282	282	3.3	46.3
IV	91.7	44.4	40.6	2.0	328	426	17.3	114.0	208	1508	281	248	4.7	45.6
1913 I	91.6	42.4	41.7	2.0	334	392	19.9	117.5	169	1473	282	221	4.7	45.4
II	90.9	43.3	41.0	1.8	332	443	17.2	116.3	187	1453	281	220	3.9	44.6
III	91.1	44.6	40.2	2.1	316	406	16.4	111.9	157	1432	276	183	3.9	44.0
IV	90.1	44.9	41.6	2.3	288	404	17.0	117.5	170	1399	270	146	4.9	43.5
1914 I	89.3	44.5	42.8	2.3	275	402	17.3	120.5	201	1422	281	128	2.4	45.1
II	86.9	40.6	38.9	2.3	267	390	16.1	114.2	174	1398	271	87	2.4	45.5

TABLE 12. — ADJUSTED FIGURES (CYCLES) FOR SELECTED SERIES: QUARTERLY, 1903–14

1. Sauerbeck-Statist prices, all "materials"
2. Exports (value) of British produce
3. Bank clearings in 5 provincial cities
4. Percentage unemployed in "all trades" (inverted)
5. Number of blast furnaces in blast
6. Exports (quantity) of iron and steel
7. Freight traffic receipts of 16 railways (see Table 9)
8. Imports (value) of raw materials excluding cotton
9. Country bank clearings through the London clearing house
10. London bank clearings on stock settling days
11. Market values of variable income securities (*Banker's Magazine* total less fixed-income securities)
12. Market values of selected British railway ordinary stocks
13. Stores of Cleveland pig iron in public warehouses
14. Discount rate on 3-months paper in London
15. Market values of 7 local government bonds (inverted)

(In terms of the standard deviation of the percentage deviations from the lines of trend as given in italics at the top of each column of this table)

Quarter		1	2	3	4	5	6	8	9	10	11	12	13	14	15
		5.68	*7.50*	*5.99*	*43.8*	*8.1*	*13.2*	*7.41*	*3.34*	*13.3*	*4.3*	*3.62*	*64.8*	*27.2*	*2.14*
1903	I	+.2	+.4	+.6	+.6	+.2	+.3	−.5	+2.4	−.1	+.4	+1.1	−.8	+.4	−.3
	II	−.1	+.2	+.2	+.7	+.1	+.4	+.7	+1.5	−.9	0	+1.1	−.8	+.7	−.3
	III	−.3	+.2	+.2	+.4	−.1	−.6	+1.6	+1.5	−.7	−.4	+.6	−.8	+.6	0
	IV	−.2	−.7	−.7	+.1	−.5	−.8	+.4	+.9	−1.2	−.9	−.6	−1.1	0	+.7
1904	I	+.2	−.6	−.4	0	−.9	−1.1	−.8	0	−1.3	−1.2	−1.4	−1.0	−.1	+1.0
	II	−.5	−.3	−.3	−.2	−.6	−.7	+.1	0	−1.2	−.5	+.6	−1.1	−.7	+.7
	III	−.7	−.4	−.3	−.2	−.7	−1.4	−.3	−.3	−.9	−.6	−.3	−1.0	0	+.6
	IV	−.5	−.5	−.2	−.3	−.6	−1.2	−1.1	−.9	+.7	+.3	+.6	−.6	−1.3	+.1
1905	I	−.6	−.5	−.5	−.1	−.3	−.8	−.8	−.9	+1.8	+.9	+.8	0	−1.0	−.5
	II	−.5	−.2	−.1	0	+.1	−.5	−.7	−.9	+.9	+1.0	+.8	+.9	−.8	−.6
	III	−.1	+.3	+.2	+.2	+.2	0	−.4	0	+1.3	+1.2	+.8	+1.4	−.5	−.1
	IV	+.6	−.1	+.5	+.5	+.7	−.4	+.4	+.3	+1.5	+1.5	+1.4	+2.1	−.1	+.3
1906	I	+.9	+.7	+.2	+.6	+.8	+.4	0	+.3	+1.3	+1.5	+1.1	+2.3	+.4	−.2
	II	+1.3	+.8	+.8	+.7	+1.0	+.6	+.8	0	+.2	+1.2	+.8	+1.9	+.7	0
	III	+1.3	+1.0	+.9	+.8	+1.0	+1.6	+.8	+.3	+1.0	+1.1	+.8	+1.7	+.9	+.5
	IV	+2.1	+.5	+1.2	+.6	+1.1	+2.0	+1.1	−.6	+.9	+1.1	−.3	+1.4	+1.8	+.7
1907	I	+2.3	+1.4	+1.3	+.8	+1.3	+2.1	+2.0	+.3	+1.4	+.6	−.3	+.9	+1.7	+.7
	II	+2.3	+2.2	+1.5	+.7	+1.4	+2.6	+1.8	+1.8	−.8	−.8	−1.1	−.4	+.8	+1.5
	III	+1.4	+2.4	+1.7	+.6	+1.3	+1.7	+.8	+.3	−.8	−1.7	−1.4	−.6	+1.4	+1.4
	IV	+.2	+1.1	+1.3	+.2	+.5	+.6	+.9	+.9	−.9	−2.6	−1.4	−1.0	+1.7	+1.2
1908	I	−.8	+.2	+.6	−.6	−.4	−.2	−1.5	0	−1.8	−2.3	−1.4	−1.1	−.1	−.1
	II	−1.4	−.4	−.4	−1.5	−.9	−.1	−1.5	−.9	−1.7	−2.0	−1.4	−1.3	−1.1	−.7
	III	−1.6	−.7	−.6	−1.9	−1.5	−.5	−1.1	−1.2	−.6	−1.5	−1.4	−1.2	−1.6	−1.1
	IV	−1.4	−1.8	−2.3	−2.1	−.8	−.9	−1.4	−1.2	−.6	−.8	−1.7	−1.0	−2.2	−.7
1909	I	−1.7	−1.8	−1.6	−1.9	−.9	−.8	−1.5	−1.8	−.2	−.7	−1.7	−.7	−1.2	−1.1
	II	−1.6	−1.4	−1.5	−2.0	−.8	−.5	−1.4	−1.8	+.7	+.2	−.8	−.5	−1.6	−2.1
	III	−1.2	−.8	−1.1	−1.7	−.6	−.5	−.8	−1.2	+.4	+.9	−.6	−.2	−1.5	−2.1
	IV	−.8	−1.2	−1.4	−1.1	−.2	−.1	+.1	−.9	+.6	+.6	−1.7	+.2	−.3	−1.5
1910	I	−.5	−.9	−1.8	−.8	−.1	+.1	+.4	−1.2	+1.1	+.6	−.8	−.1	−.8	−1.3
	II	−.6	−.1	−.2	−.1	+.3	+.1	+2.6	+1.2	+.5	+.7	0	+.4	+.3	−1.1
	III	−.6	+.2	−.7	+.1	+.3	+.1	+.4	0	+.4	+.1	0	+.5	−.2	−.9
	IV	−.2	−.4	−.3	−.2	+.2	−.2	−.1	−.9	+.2	+.3	0	+.8	−.2	−.4
1911	I	−.1	+.1	0	+.5	+.3	−.1	−.4	−.3	+.3	+.6	+1.1	+.9	−.6	−1.0
	II	0	0	0	+.5	−.4	−.1	−.7	−.6	+.5	+1.0	+2.5	+1.0	−.8	−.8
	III	−.6	−1.1	0	+.5	−.7	−1.3	−1.4	−.6	+.2	+.3	+1.1	+1.0	−.3	0
	IV	−.7	+.2	+.2	+.8	−.4	+.2	−.5	−.3	−.5	+.1	+.8	+.9	−.7	−.1
1912	I	−.3	0	−.8	−1.0	−3.8	+1.0	−.3	−1.2	+.2	+.2	+.6	+.6	−.2	−.3
	II	+.2	−.9	−.5	+.3	−1.5	−1.7	−.8	+1.5	+.5	+.6	+.6	−.1	−.1	−.5
	III	+.7	+.7	+.9	+.9	+1.1	+.3	+.4	+.6	+.1	+.7	+.6	−.3	+.4	+.2
	IV	+1.0	+.7	+.6	+1.2	+1.3	+.1	+.9	+.6	+.6	+.5	+.3	−.4	+.4	+.8
1913	I	+.9	+.3	+.3	+1.1	+1.5	+.1	+1.5	+1.2	−.6	0	+.3	−.6	+1.1	+.9
	II	+.7	+1.1	+1.4	+.9	+1.5	+.4	+.4	+1.5	−.5	−.3	+.6	−.6	+.8	+1.6
	III	+.7	+.6	+1.0	+.9	+.9	−.3	+.1	+.6	−1.0	−.6	+.6	−.8	+1.0	+2.0
	IV	+.4	+.2	+.5	+.9	−.3	−.4	+.1	+.6	−1.0	−1.1	−.3	−.9	+.4	+2.4
1914	I	+.1	+.4	+.3	+.8	−.8	+.1	−1.1	+.9	0	−.7	+.6	−1.0	−1.4	+.7
	II	−.4	−.3	0	+.5	−1.1	−.8	−.9	0	−1.2	−1.1	0	−1.2	−.8	+.2